(12) UK Patent Application (19) GB (11) 2 061 811 A

(21) Application No 7938092
(22) Date of filing
2 Nov 1979
(43) Application published
20 May 1981
(51) INT CL³ B29D 7/00
(52) Domestic classification
B5B 35Y 363 FC
(56) Documents cited
GB 1469211
GB 805858
US 3650644 A
(58) Field of search
B5B
(71) Applicant
Raymond Daniel Le-Roy Harvey
Kendal Lodge
The Broadway
Totland Bay
Isle of Wight
(72) Inventor
Raymond Daniel Le-Roy Harvey
(74) Agents
D Young & Co
10 Staple Inn
London WC1V 7RD

(54) Cooling blown extruded tubular film

(57) A tube (4) of plastics material extruded by an extruder (1), is inflated by compressed air from a nozzle (6) and the expanded tube (7) is passed between pinch rollers (8) to a storage roll (9). To expedite cooling of the inflated tube (7), the tube (7) is surrounded by a column (10) and cooled air from a fan/cooler unit (12) is supplied through a hose (13) to an annular space (11) between the tube (7) and the column (10) and extracted from the space (11) by a hose (14) and returned to the unit (12). Irises may be provided at the top and bottom of the column (10) to seal the ends of the space (11) and plenums at the top and bottom of the column (10) preferably cause a toroidal air flow in the space (11).

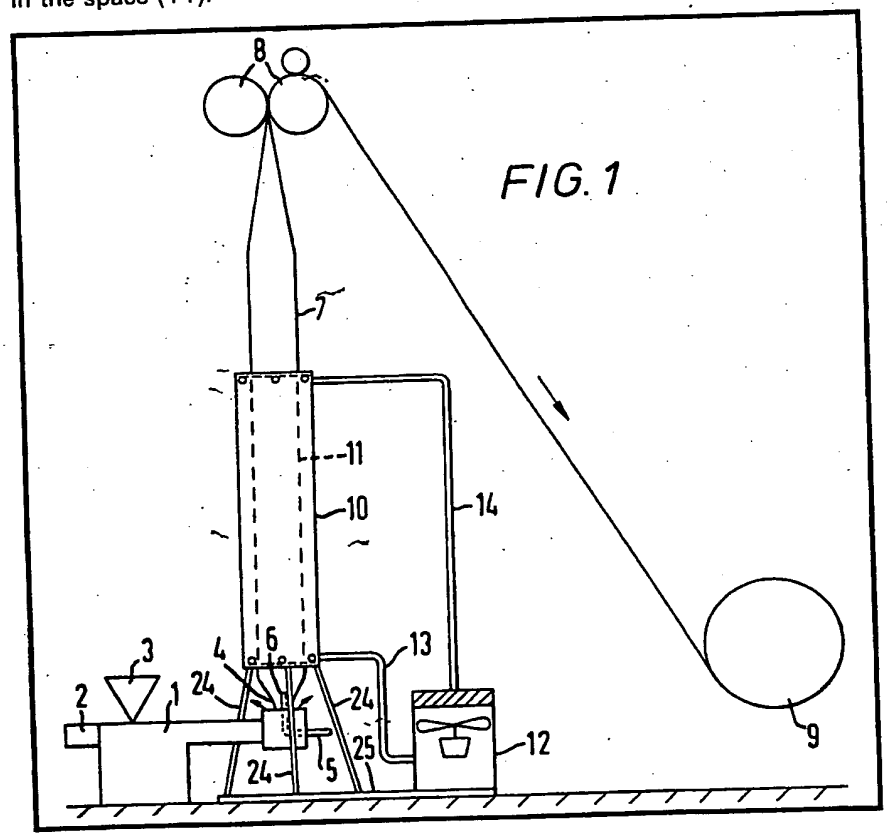

FIG. 1

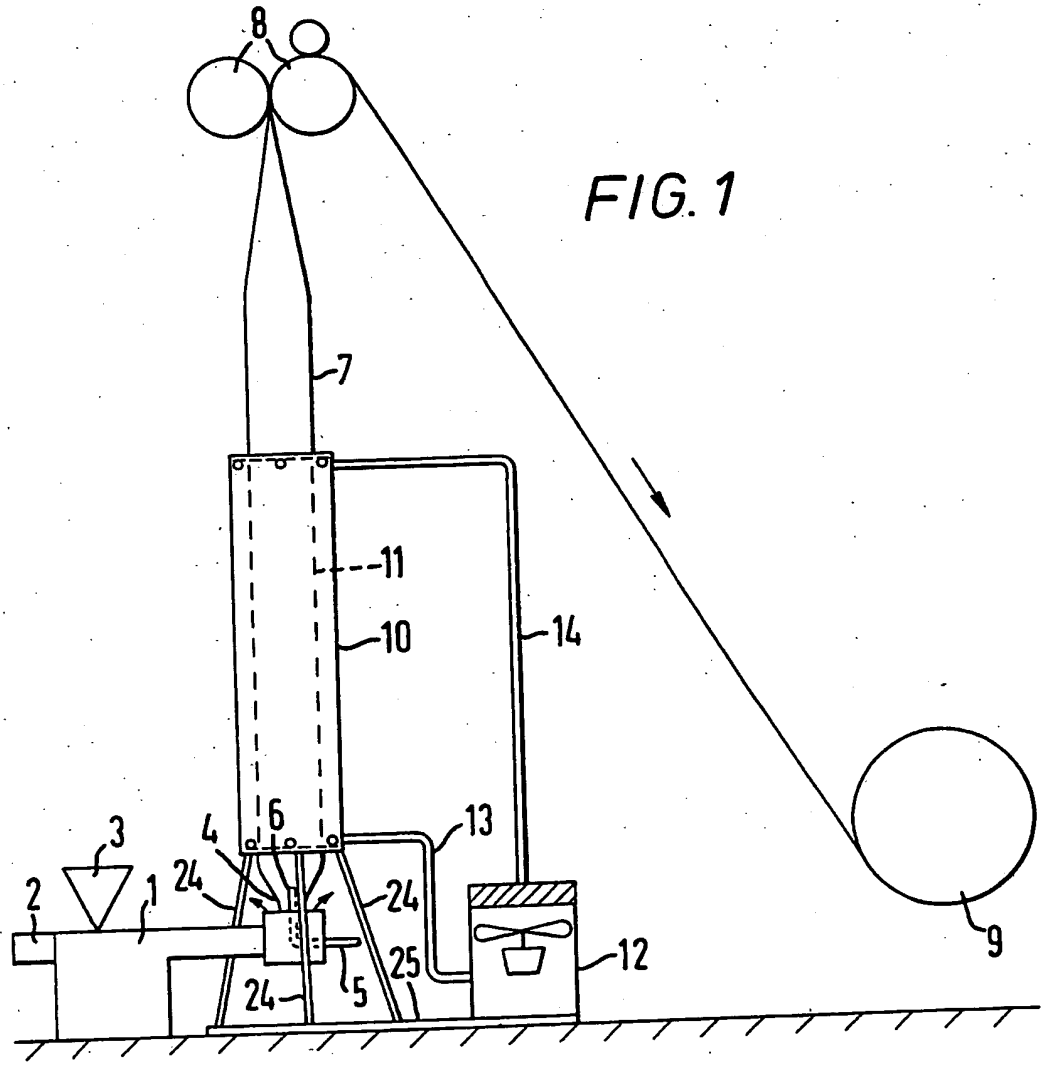

FIG. 1

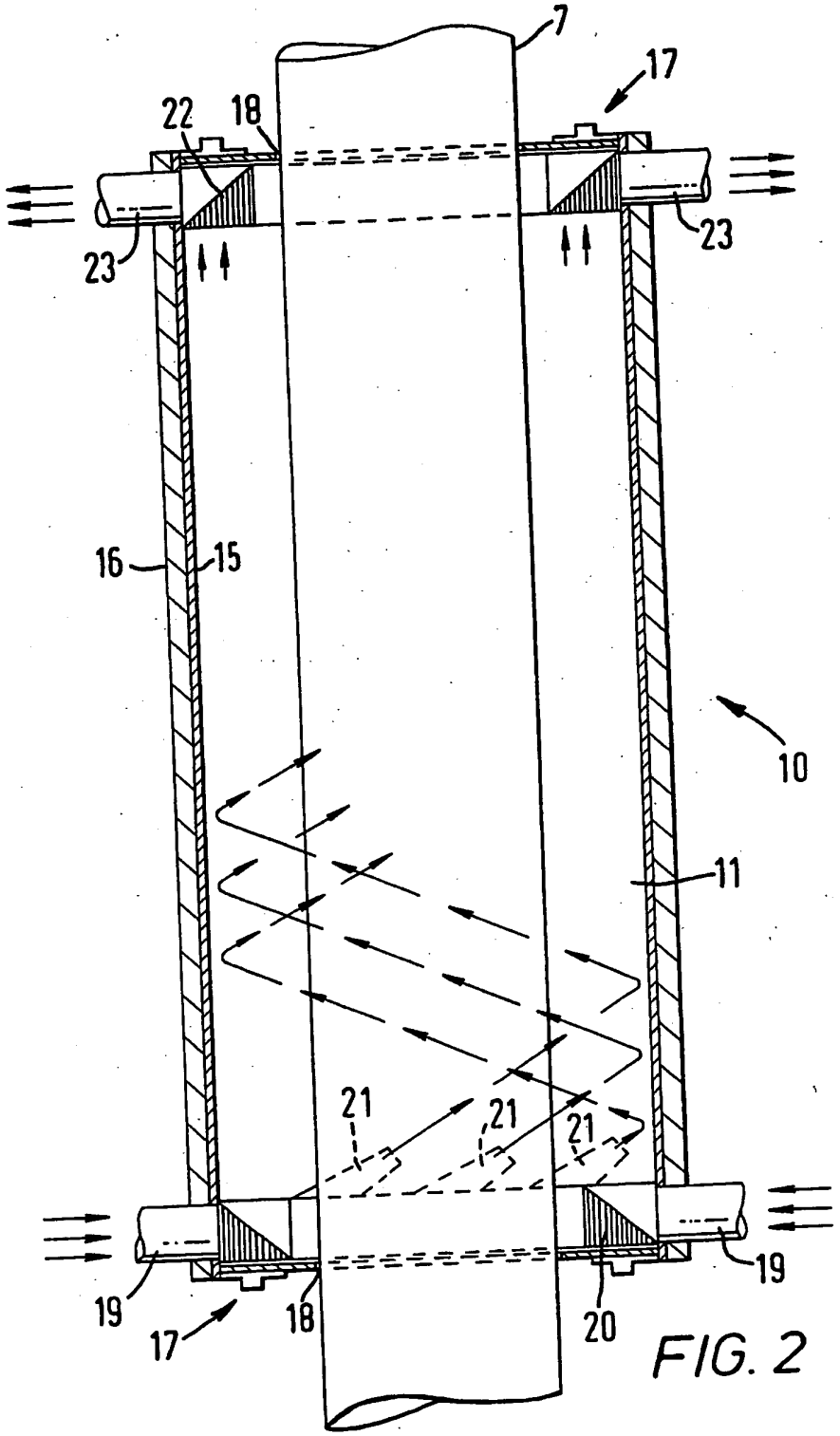

FIG. 2

SPECIFICATION

Improvements relating to cooling blown extruded tubular film

The invention relates to the formation of blown extruded tubular film and particularly to cooling thereof.

Plastics film, particularly polythene film, can be formed by extruding a tube of polythene, for example between 2" and 4" in diameter, closing of the end of the tube first extruded and supplying air under pressure to within the tube to expand the tube to a much larger diameter, for example 10' diameter, to form film of a desired thickness. Usually the tube is extruded in a vertically upward direction and the extruded tube, expanded by air pressure, is pulled upwardly and eventually passes between a pair of pinch rollers which prevent the air within the tube from escaping, the tube being conveyed from the pinch rollers in a "laid flat" condition and rolled up for storage in that condition or slit and opened out and stored in single thickness on a roll.

Due to the high temperature at which the plastics tube leaves the extruder, it is necessary for the pinch rollers to be a considerable height above the extruder to allow the tubular film to cool sufficiently so that as it passes therebetween it does not stick to the pinch rolls and one side of the tube does not stick to the other side. The required distance between the extruder and the pinch rolls may be as much as 40'.

Various attempts have been made to cool the film more quickly so that the height of the pinch rolls above the extruder can be reduced and these have generally comprised cooling of the air within the tubular film. Thus a cooling unit has been mounted on the core of the extruder, so that it is located within the tubular film and the air within the tubular film has been passed through the cooling unit to cool it. The cooling unit was supplied with iced water supplied through the core of the extruder and it has even been proposed to supply the cooling unit with a refrigerant which changes state in its working cycle, *i.e.* between a gas and a liquid. The core of the extruder is however at high temperature and most of the cooling effect is therefore lost before the coolant reaches the cooling unit.

Ambient temperature is very significant in such a method of producing film by blowing an extruded tube such that the production rate can be considerably increased on a night shift compared to a day shift due to the lower ambient temperature and winter production rates can be higher than summer production rates.

According to one aspect of the invention, a method of cooling an expanded tube of extruded plastics material comprises surrounding at least a portion of the expanded tube, intermediate the position of extrusion of the extruded tube of the plastics material and pinch rolls between which the cooled and expanded tube is passed, by a tubular column; supplying cooling air to an annular space between the tubular column and the expanded tube; and sealing at least one of the ends of the said annular space to reduce leakage of cooling air therefrom.

According to a further aspect of the invention, cooling apparatus for cooling an expanded tube of extruded plastics material comprises a tubular column to surround an expanded tube of extruded plastics material, means to supply cooling air to an annular space between the column and the expanded tube and at least one end seal on the column to close off said annular space at a position or positions adjacent one or both ends of the column.

Preferably an end seal is provided at each end of the column and comprises an adjustable iris, that is to say an annular member formed of a plurality of parts which are relatively movable such that the inner diameter of the annular member is adjustable in size.

The means to supply cooling air to the annular space preferably comprise a fan to cause flow of air through a cooler unit and hoses connecting the cooler unit to opposite ends of the column. At the lower end of the column, above the lower adjustable iris thereof, a plenum is provided with upwardly directed outlets, the outlets being so angled that jets of air flowing from the plenum into the annular space cause a toroidal flow of air in the annular space in an upward direction, a collector being provided at the upper end to extract the air from the column and feed it back to the fan cooler unit. The column could for example, be formed of sheet steel and if desired could be split longitudinally and provided in two relatively hinged together parts such that it could be opened up, particularly to allow the extruded tube to be drawn therethrough when first starting an extruding operation. Preferably the column is mounted on legs which are adjustable in height and may be mounted as a wheeled unit together with the fan cooler whereby it can relatively easily be moved to provide cooling for different extruders. The column may be provided with an insulating jacket to prevent undesirable heat gain thereof from the surrounding atmospheric air.

The direction of air flow in the column could be the same as or opposite to the direction of movement of the extruded expanded film through the column, as desired for particular operating circumstances.

Further features of the invention are illustrated in the accompanying diagrammatic drawings, in which:—

Figure 1 is an elevation of an extruder producing expanded tubular plastics film and

cooperating with apparatus according to said further aspect of the invention; and

Figure 2 is a more detailed view of a middle part of Fig. 1.

Referring to the drawings, an extruder 1 has a drive motor 2 to rotate an extruder screw (not shown) which plasticises plastics material fed to a feed hopper 3 and forces the plasticised material through an annular extrusion orifice as an extruded tube 4 of the plastics material. Compressed air can be supplied to a feed pipe 5 to pass through the core of the extruder outlet to a nozzle 6 whereby compressed air can be supplied to the interior of the tube 4. By sealing the end of the tube 4 first extruded, the tube 4 can be expanded to a diameter considerably greater than the diameter at which it was extruded to form a larger diameter tube 7 of film which, when cooled, can pass between a pair of pinch rollers 8 and be drawn downwardly and rolled up for storage on a reel 9.

To expedite cooling of the expanded tubular film 7 after leaving the outlet orifice of the extruder 1 and before being drawn between the pinch rollers 8, the tube 7 is passed through a column 10 which surrounds the tube 7 and has seals at its ends to seal off the annular space 11 between the tube 7 and the column 10. A cooler/blower unit 12 feeds air through a hose 13 to the lower end of the column 10 and withdraws air from the upper end of the column 10 through a hose 14.

Referring now to Fig. 2, the column 10 has an inner annular sheet steel wall 15 provided with an outer heat insulating jacket 16. An annular iris 17 is provided at each end of the column 10 and each iris 17 is adjustable so that the diameter of the orifice therein can be made only slightly larger than the diameter of the expanded tube 7 passing therethrough so that the inner edge 18 of the iris lies closely adjacent the outer face of the expanded film 7 around the periphery thereof.

The supply hose 13 shown in Fig. 1 is branched and fed to two tubular inlets 19 at the lower end of the column 10, the tubular inlets 19 feeding a plenum 20 in the lower end of the column 10, the plenum 20 has a plurality of angled discharge nozzles 21 such that air discharged therefrom passes in a helical toroidal path upwardly through the annular space 11 between the outer surface of the expanded tubular film 7 and the inner surface of the sheet steel wall 15 of the column 10. In its upper end the column 10 has a further plenum 22 which collects the air passing upwardly through the annular space 11 and discharges it through a pair of discharge pipes 23, which pipes 23 merge and are coupled to the return pipe 14 shown in Fig. 1 to feed air back to the cooler/blower unit 12. While an upwardly spiralling flow of air is shown in Fig. 2, it will be appreciated that the column 10 could if desired be inverted so that it would have a downward flow of air therethrough, *i.e.* a flow of air against the direction of movement of the expanded extruded tube 7. Fig. 1 shows that the column 10 is mounted on legs 24, which legs 24 would preferably be adjustable and might well be provided to extend from a platform 25 which also carried the cooler/blower unit 12 such that the whole unit could be moved relatively easily from one extruder to another.

The inner edges 18 of the iris 17 also act as guides for the tubular film 7 and can be so close thereto that approximately 75% of the air fed to the plenum 20 can be extracted through the plenum 22.

It will be appreciated that the apparatus described can have the advantages that the rate of production of film can be increased without the film still being sticky when it reaches the pinch rollers 8. Alternatively the height of the pinch rollers 8 above the extruder 1 can be reduced for the same production rate. The conditions within the annular space 11 can be much more stable than in an open factory area such that the quality of the film can be more consistent. The apparatus can be portable and can be applicable not only to new but also to existing extruders. The apparatus can be produced without expensive tooling costs.

CLAIMS

1. A method of cooling an expanded tube of extruded plastics material comprising surrounding at least a portion of the expanded tube, intermediate the position of extrusion of the extruded tube of the plastics material and pinch rolls between which the cooled and expanded tube is passed, by a tubular column; supplying cooling air to an annular space between the tubular column and the expanded tube; and sealing at least one of the ends of the said annular space to reduce leakage of cooling air therefrom.

2. Cooling apparatus for cooling an expanded tube of extruded plastics material comprising a tubular column to surround an expanded tube of extruded plastics material, means to supply cooling air to an annular space between the column and the expanded tube and at least one end seal on the column to close off said annular space at a position or positions adjacent one or both ends of the column.

3. Cooling apparatus according to claim 2, in which an end seal is provided at each end of the column and each end seal comprises an adjustable iris in the form of an annular member having a plurality of parts which are relatively movable such that the inner diameter of the annular member is adjustable in size.

4. Cooling apparatus according to claim 2 or claim 3, in which the means to supply cooling air to the annular space comprise a

cooler unit, a fan to cause flow of air through the cooler unit and hoses connecting the cooler unit to opposite ends of the column.

5. Cooling apparatus according to claim 4, when appendant to claim 3, in which at the lower end of the column, above the lower adjustable iris thereof, a plenum is provided with upwardly directed outlets, the outlets being so angled that jets of air flowing from the plenum into the annular space cause a toroidal flow of air in the annular space in an upward direction, and a collector is provided at the upper end to extract the air from the column and feed it back to the fan cooler unit.

6. Cooling apparatus according to any one of claims 2 to 5, in which the column is split longitudinally to form two relatively hinged together parts such that it can be opened up to allow the extruded tube to be drawn therethrough when first starting an extruding operation.

7. Cooling apparatus according to any one of claims 2 to 6 in which the column is mounted on legs which are adjustable in height.

8. Cooling apparatus according to claim 4, or any one of claims 5 to 7 when appendant to claim 4, mounted as a wheeled unit together with the fan and cooler unit whereby it can relatively easily be moved to provide cooling for different extruders.

9. Cooling apparatus according to any one of claims 2 to 8, in which the column is provided with an insulating jacket to prevent undesirable heat gain of the column from the surrounding atmospheric air.

10. A method of cooling an expanded tube of extruded plastics material as claimed in claim 1 and substantially as hereinbefore described.

11. Cooling apparatus for cooling an expanded tube of extruded plastics material substantially as hereinbefore described and illustrated with reference to the accompanying drawings.

Printed for Her Majesty's Stationery Office
by Burgess & Son (Abingdon) Ltd.—1981.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained